Carbon and Air Quality Emissions for East Hampton NY and its Airport

Don Wuebbles
University of Illinois
Urbana, IL

I am indebted to my colleagues for their help:

Dr. Swarnali Sanyal – Postdoctoral Research Associate

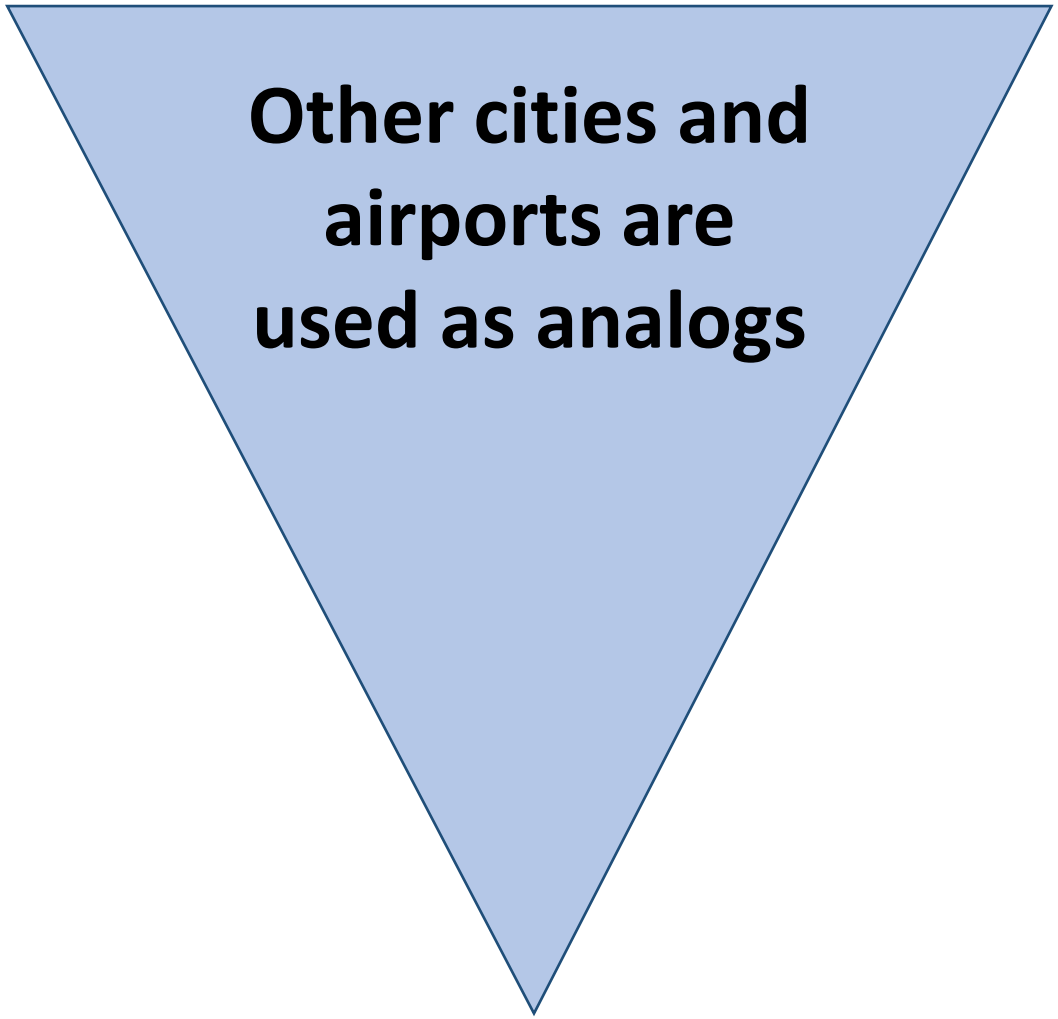
Alexa Nallen – Undergraduate

Sydney Carste – Undergraduate

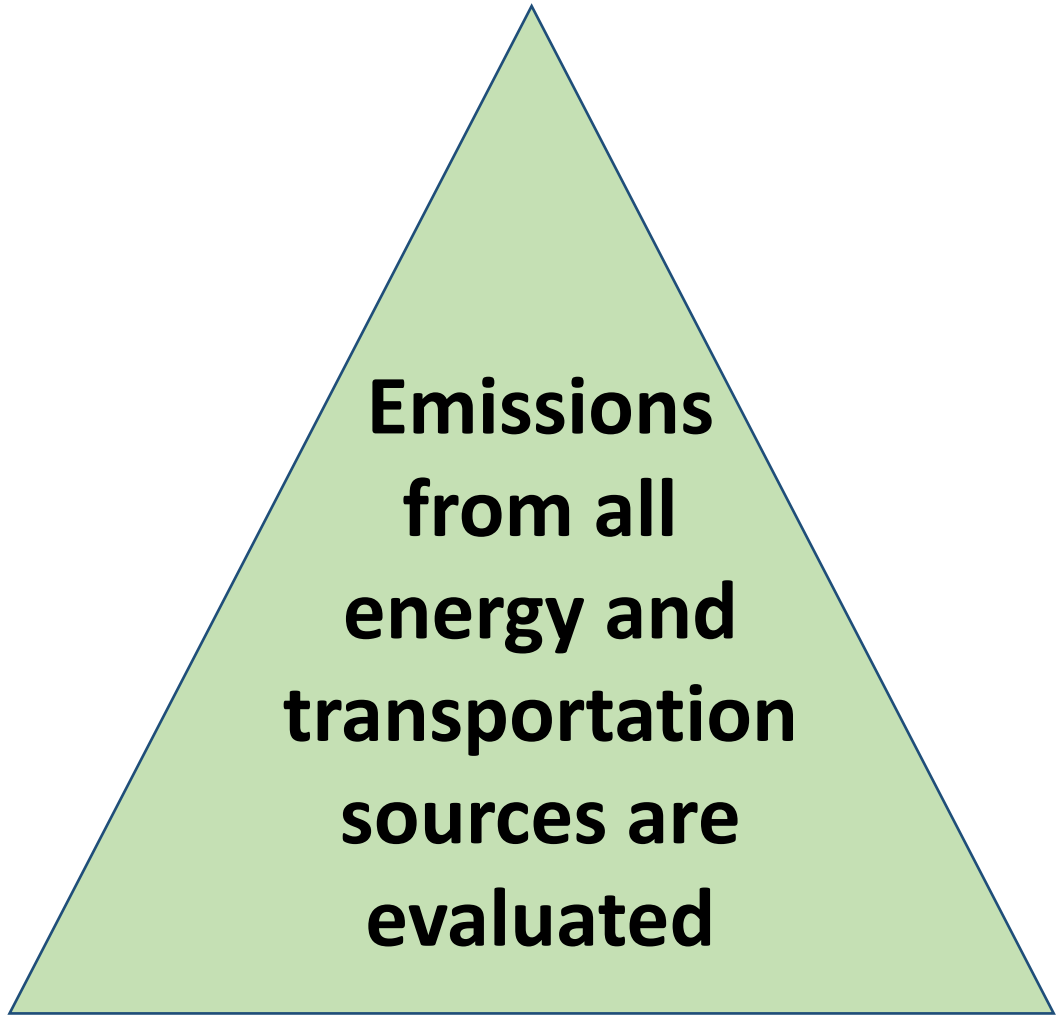
Objectives and Approach

- **Objectives: Evaluating the emissions of gases and particles from East Hampton, NY, and its airport.**
  - The focus is on human-related emissions for carbon dioxide and other heat trapping greenhouse gases, with consideration also given to the pollutants that affect local air quality.
- **Especially aimed at the airport, but it is important to put those emissions into context of those by the community.**
- **Two types of analyses are used:**
  - Top-down approach
  - Bottom-up approach

Top Down Analyses



Bottom Up Analysis



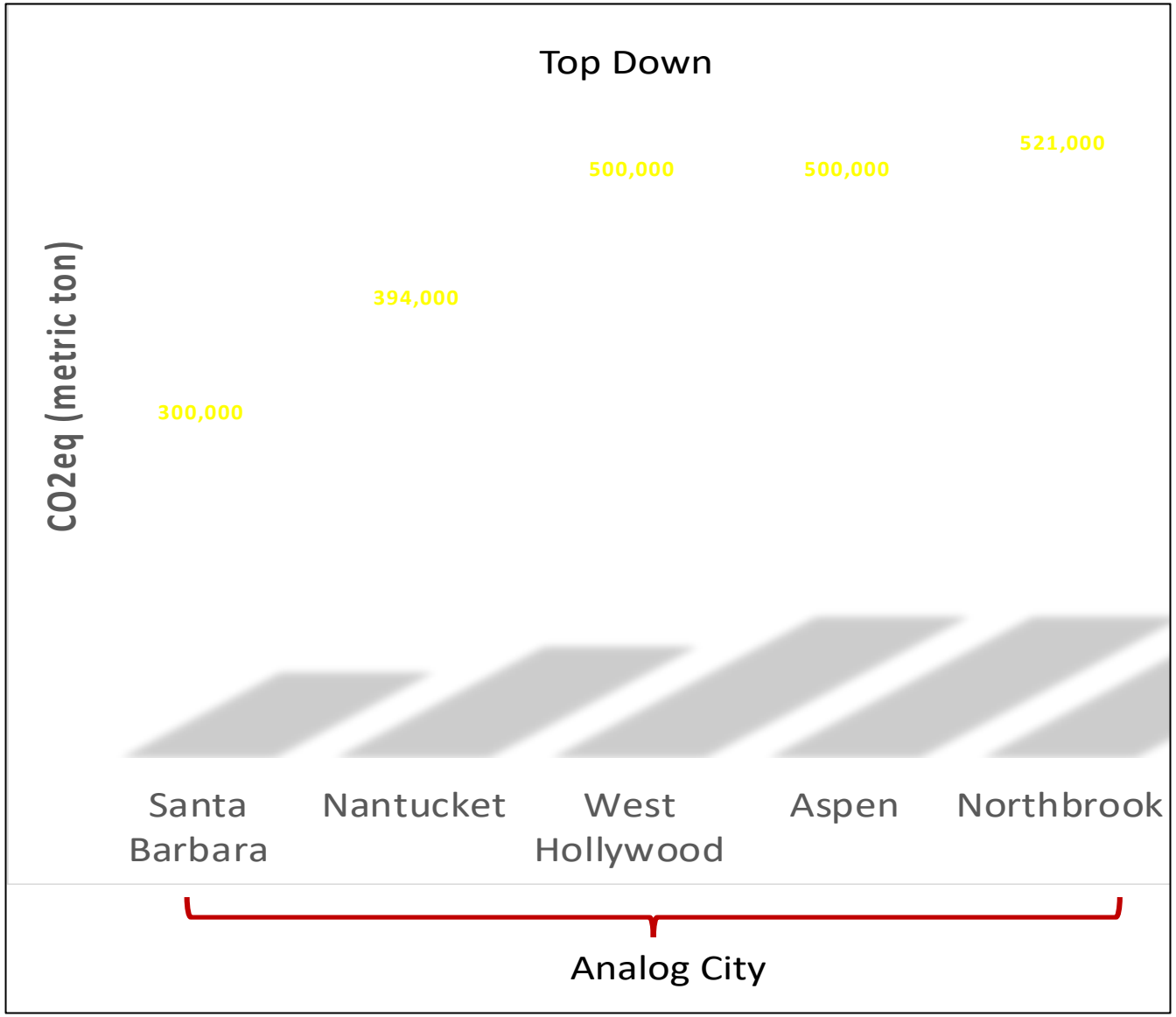
Top Down Analyses

- **Several wealthier communities selected as analogs for East Hampton (stars mean also did airport)**
  - Northbrook, IL (population: 33K; median income: $123K)
  - **Aspen, CO (population: 7K – more summer/winter; income: $73K)
  - **West Hollywood, CA (population: 36K; median income: $79K)
  - **Santa Barbara, CA (population: 91K; median income: $74K)
  - Nantucket, MA (population: 11K year around and 56K summer; median income: $148K)
  - Teterboro, NJ airport (serves Manhatten and other key communities)
- Scaled with seasonal population or airport LTOs to estimate emissions
- Tried to analyze many more but depended on their being existing emissions analyses and often couldn't find them.
  - Jones & Kammen (2014) report for most cities doesn't seem to be very accurate.

Top-Down Analyses: City of East Hampton

Estimated annual CO_{2eq} emissions from the top-down approach for the city of East Hampton in 2019.

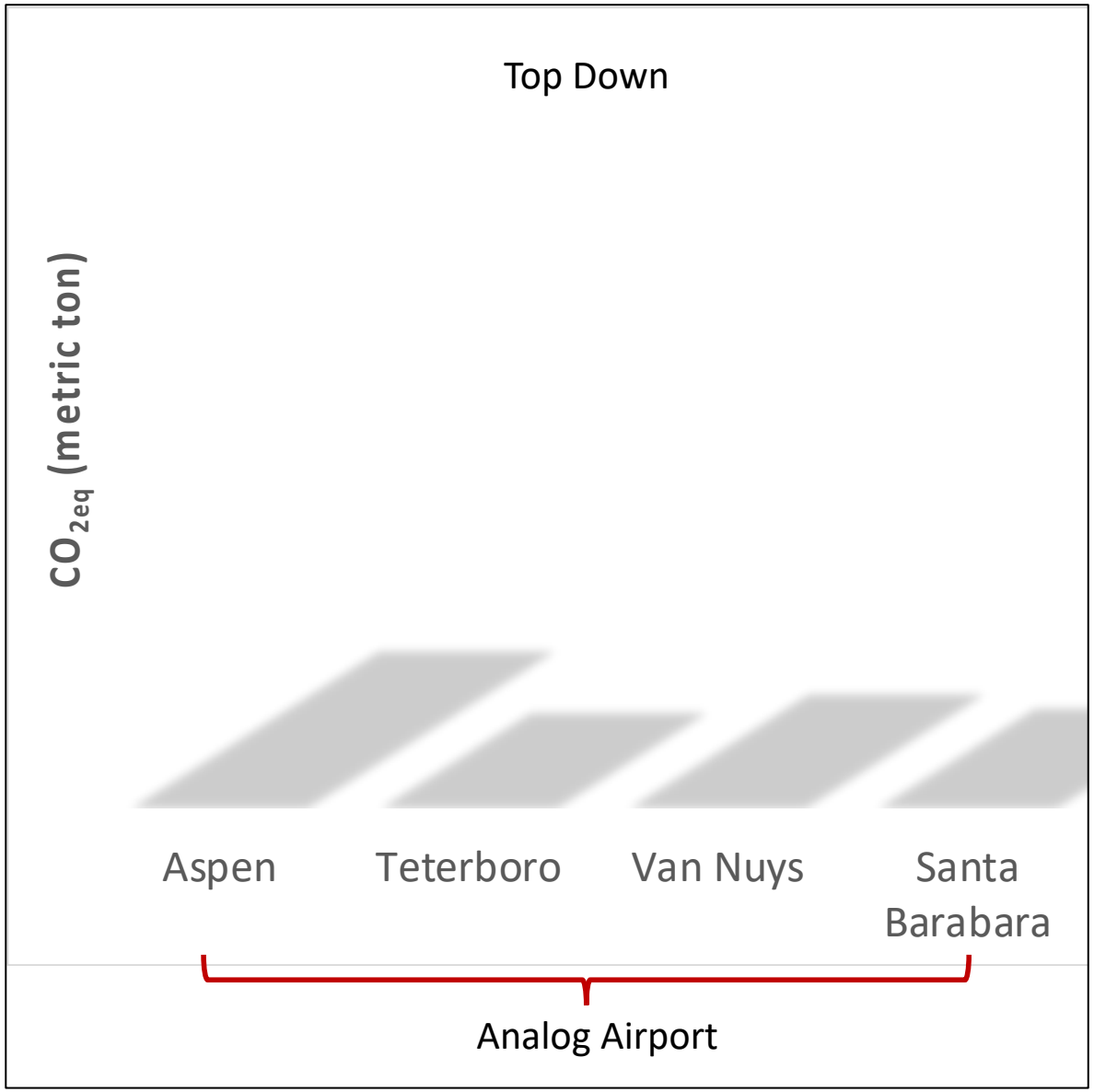
The names of the cities in the top-down approach are the ones used as analogs to estimate emissions from East Hampton



Top-Down Analyses: East Hampton Airport

Estimated CO_{2eq} emissions from the top-down approach for the East Hampton Airport in 2019 (annual total).

The names of the airport in the top-down approach are the airports used as analogs to estimate emissions for the East Hampton airport.



Bottom-Up Analyses: Town of East Hampton

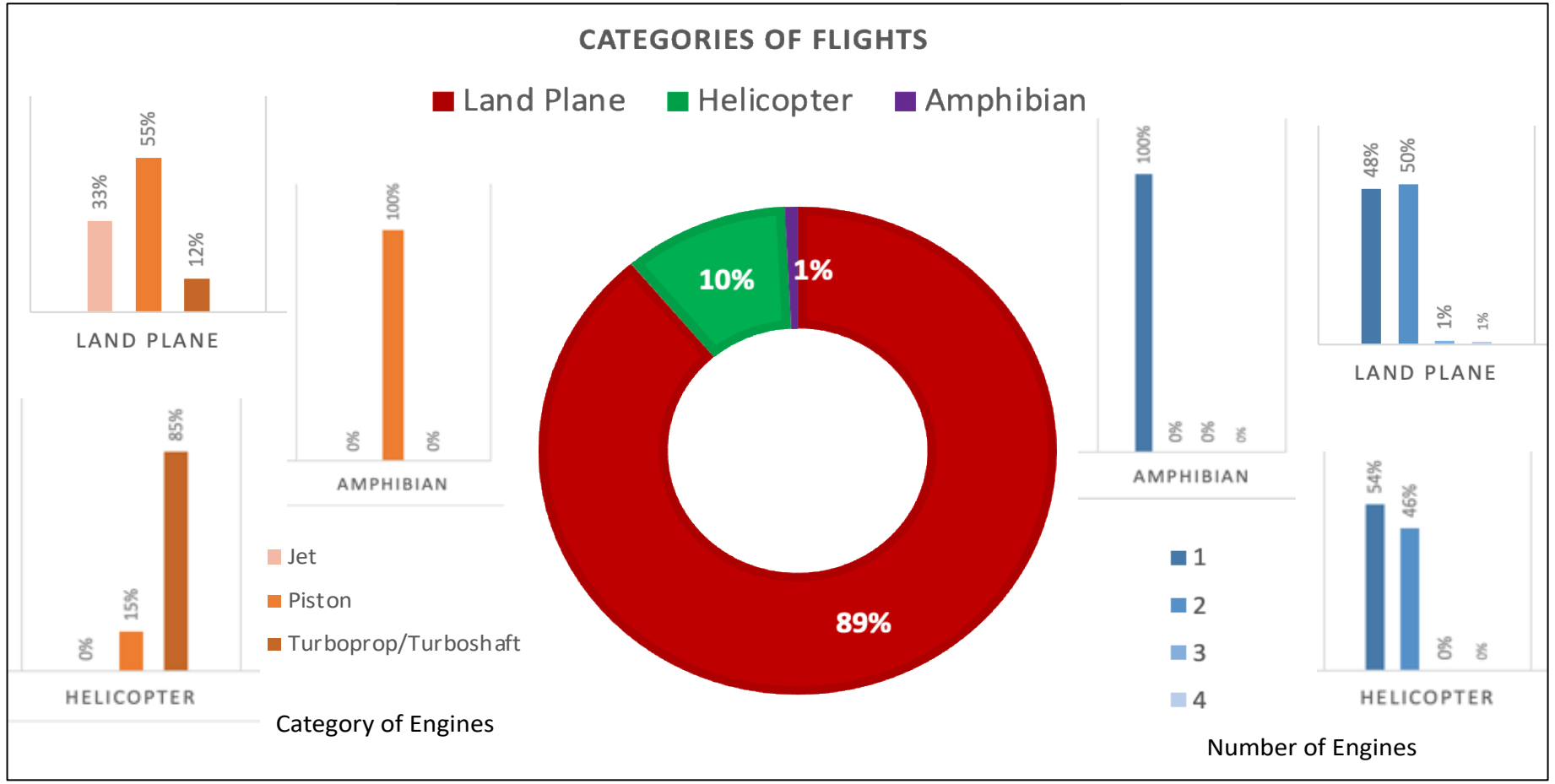
- **Consider Town of East Hampton Climate Action Plan (October 2015)**
  - East Hampton is trying to move to a complete renewable sources of energy across economy and towards becoming a model resilient coastal community in the United States.
  - The total CO_{2eq} emission in 2010 was reported as 352,400 metric ton, which was reduced from 364,930 metric tons in 2005.
- We assume the same rate of annual reduction of CO_{2eq} (0.68% annually).
- **The estimated bottom up CO_{2eq} emissions in 2019 are 330,000 metric tonnes ($MTCO_2$ per year).**
- **There remain significant uncertainties in this evaluation because of insufficient data to provide a more complete analysis.**

Bottom-Up Analyses: East Hampton Airport

We were provided a spreadsheet with listing of the flights at East Hampton airport for the 255 unique aircraft and their LTO info.

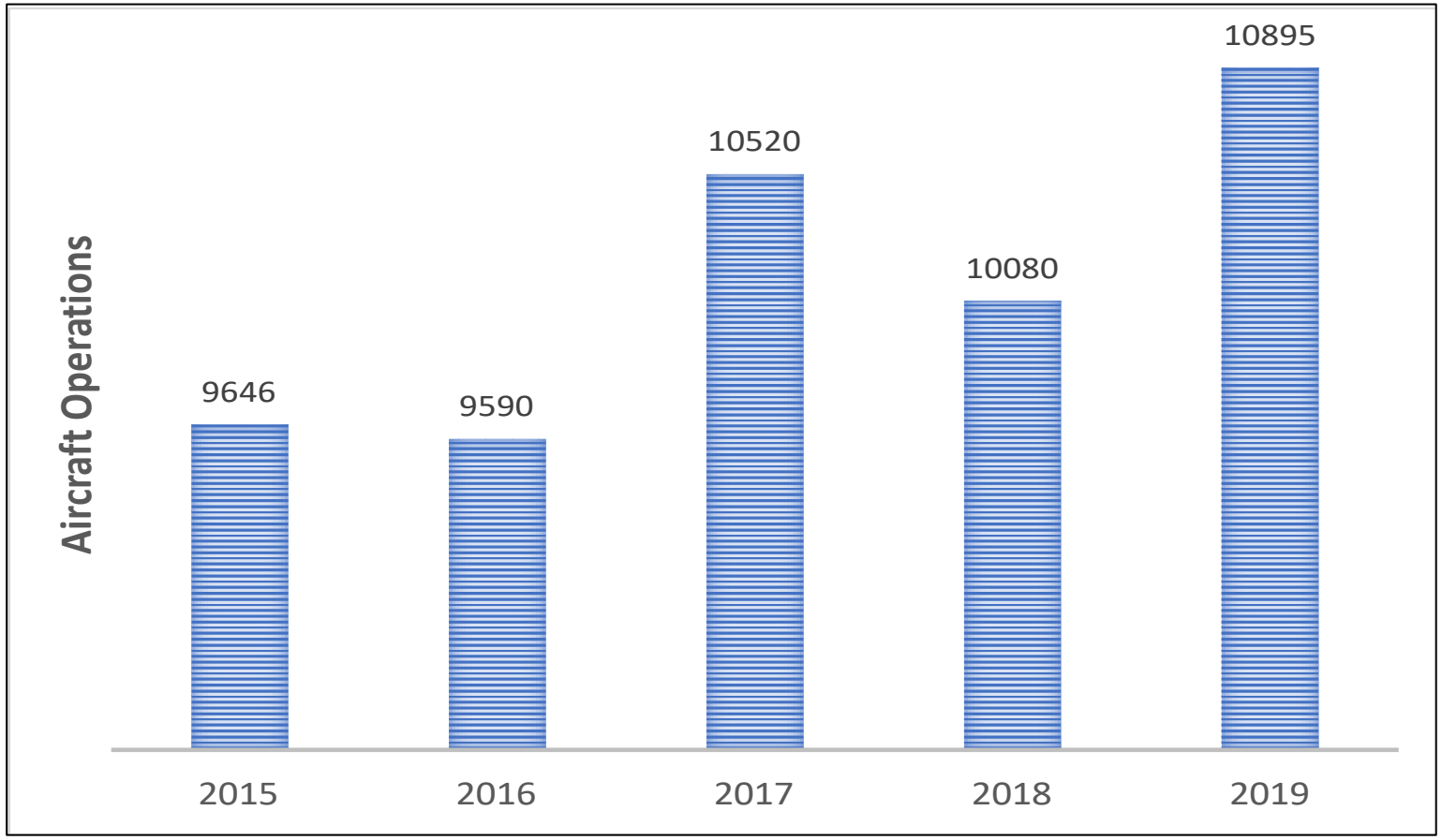
Determine:
Aircraft emissions during LTO for different aircraft, Emissions from auxiliary power units (APU), and Emissions from ground transportation.

Depends on:
- the total number of flights per type of aircraft,
- the relevant time period for surface emission and,
- the pollutant type and its emissions rate.



Bottom-Up Analyses: East Hampton Airport

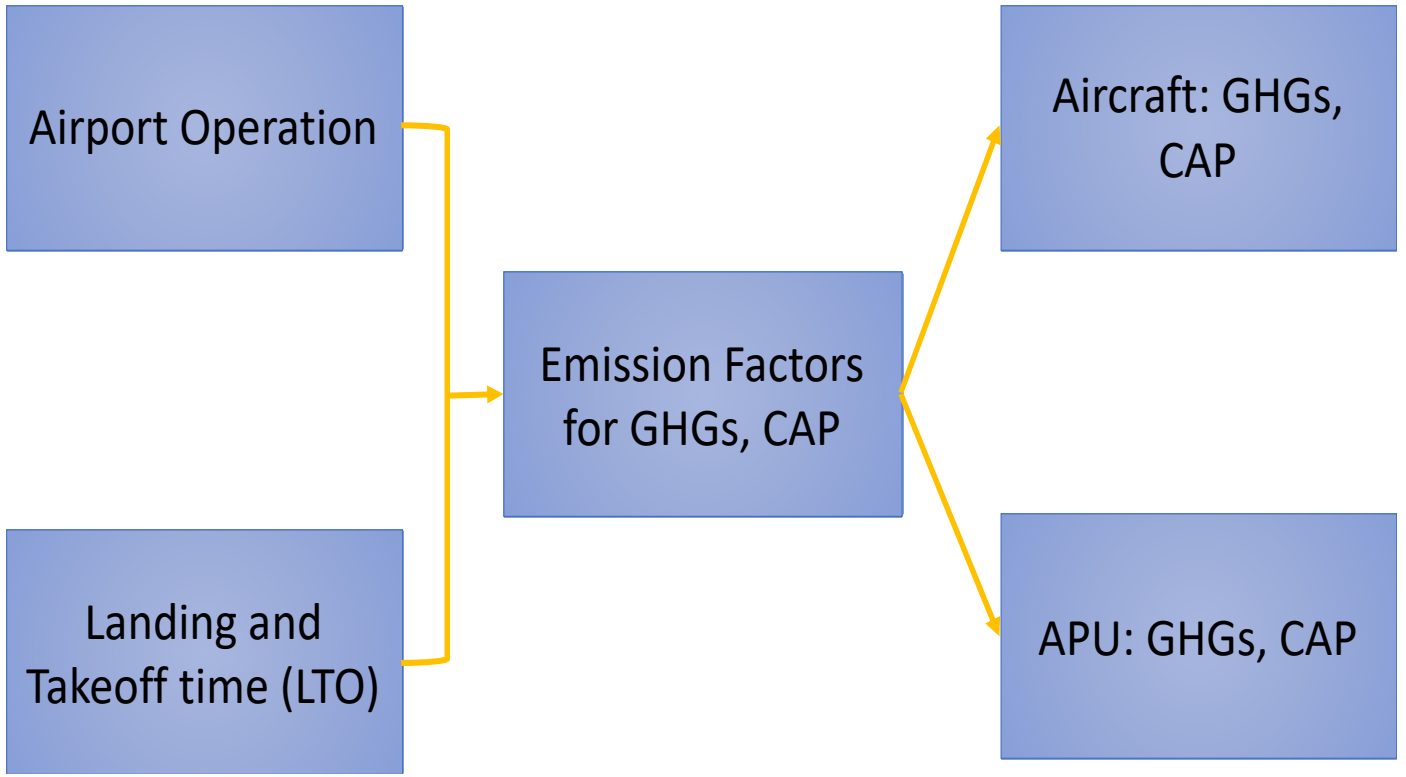
Number of aircraft operations (all categories) at East Hampton Airport during the July-September time period



Bottom-Up Analyses: East Hampton Airport

General Structure of Emissions Inventory for East Hampton Airport

Concerned about Takeoffs and Landings, not emissions at cruise



Bottom-Up Analyses: East Hampton Airport

Emission rate per unit flight operation for different type of greenhouse gases (GHG) and criteria air pollutants (CAP) that were used in the bottom-up analysis for East Hampton

	Aircraft LTO	APU
	metric ton per unit operation	
GHG		
$CO_{2\ eq}$	0.99400	0.02070
CO_2	0.97900	0.02030
CH_4	0.00007	0.00000
N_2O	0.00005	0.00000
CAP		
SO_2	0.00036	0.00001
NO_x	0.00317	0.00005
$PM_{2.5}$	0.00003	0.00001

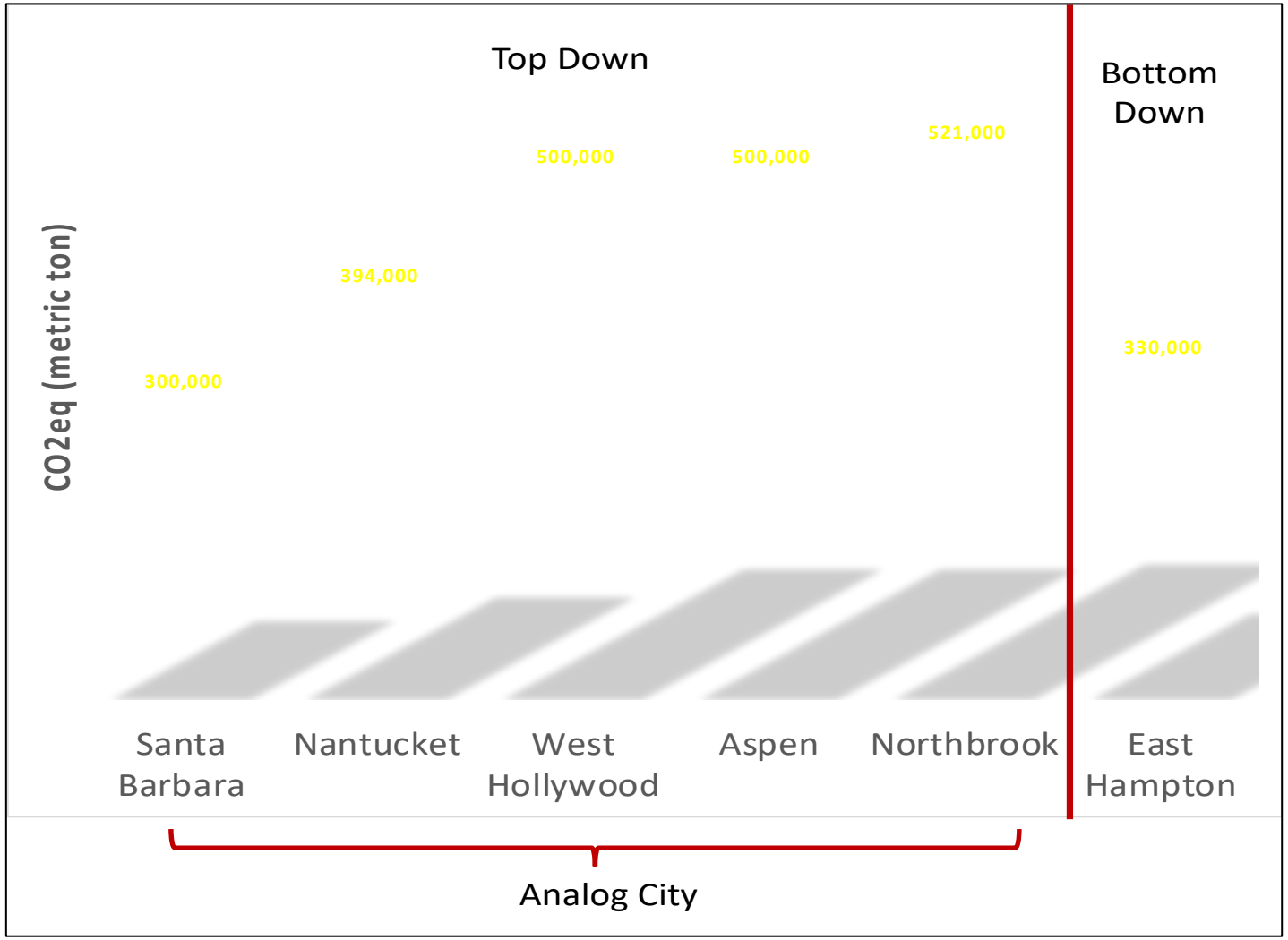
Bottom-Up Analyses: East Hampton Airport

Greenhouse gas (GHG) and Criteria Air Pollutant (CAP) emission during summer season from 2015-2019 and the annual emissions for 2019 from the aircraft LTO and the auxiliary power unit (APU), plus the total (sum of aircraft and APU emission). Units are metric tonnes for the time period (either summer season or year).

Metric ton		2015	2016	2017	2018	2019	2019 annual
GHG							
CO_{2eq}	Airport	9590	9530	10,500	10,000	10,800	18,600
	APU	199	198	217	208	225	387
	Total	**9780**	**9730**	**10,700**	**10,200**	**11,100**	**19,000**
CO_2	Airport	9440	9390	10,300	9860	10,700	18,300
	APU	196	195	214	205	221	380
	Total	9640	9580	10,500	10,100	10,900	18,700
CH_4	Airport	0.71	0.70	0.77	0.74	0.80	1.37
	APU	0.02	0.02	0.02	0.02	0.02	0.03
	Total	0.73	0.72	0.79	0.76	0.82	1.41
N_2O	Airport	0.44	0.44	0.48	0.46	0.50	0.85
	APU	0.01	0.01	0.01	0.01	0.01	0.01
	Total	0.45	0.44	0.49	0.47	0.50	0.86
CAP							
SO_2	Airport	3.51	3.49	3.83	3.67	3.97	6.81
	APU	0.07	0.07	0.08	0.08	0.08	0.14
	Total	3.58	3.56	3.91	3.75	4.05	6.95
NO_x	Airport	30.60	30.40	33.40	32.00	34.50	59.30
	APU	0.52	0.52	0.57	0.55	0.59	1.01
	Total	31.10	30.90	33.90	32.50	35.10	60.30
$PM_{2.5}$	Airport	0.28	0.28	0.31	0.30	0.32	0.55
	APU	0.07	0.07	0.07	0.07	0.08	0.13
	Total	0.35	0.35	0.38	0.37	0.40	0.68

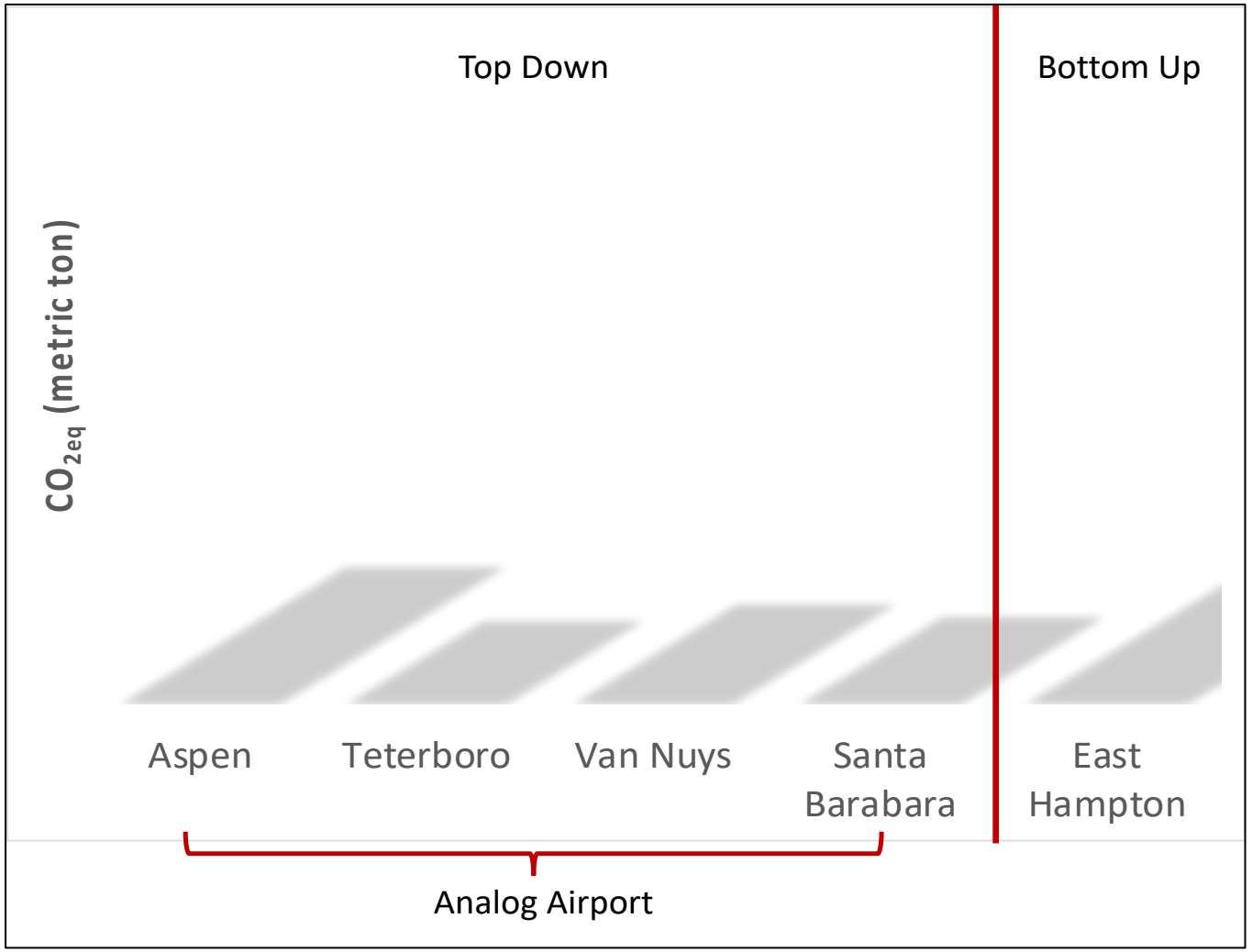
Summary: Town of East Hampton

Estimated annual CO_{2eq} emissions from the top-down and bottom-up approaches for the city of East Hampton in 2019.



Summary: East Hampton Airport

Estimated CO_{2eq} emissions from the top-down and bottom-up approaches for the East Hampton Airport in 2019 (annual total).



Conclusions

- Evaluate emissions of gases and particles from East Hampton, NY, and its airport. Focus is especially on human-related emissions for carbon dioxide and other heat trapping greenhouse gases.
- Two types of analyses are used, a top-down and a bottom-up approach.
- **Analyses show East Hampton airport does provide a meaningful but small contribution to total carbon dioxide and air quality emissions relative to the emissions from the community itself.**
  - The top-down analyses show a best range of about 13,900-21,900 $MTCO_2$. The bottom-up analysis produced a value of about 19,000 $MTCO_2$ for the year of 2019. The summer season emissions are a high fraction of this, at about 11,000 $MTCO_2$.
  - In comparison, the town of East Hampton has about 330,000 $MTCO_2$ per year emissions from the bottom-up analysis (and a range of 300,000 to 521,000 $MTCO_2$ per year from the top-down analyses).

Conclusions (cont.)

- **Overall, the emissions of East Hampton itself, not including the airport, are likely much larger than the emissions from its airport. However, the emissions from the airport are not negligible.**
  - **The emissions from the airport accounted for almost 6% (5.7% if use the bottom-up numbers) of East Hampton's total carbon emissions.**
  - As the town continues to become more energy efficient, switch to alternative energy sources, and overall reduce its emissions, the airport will likely contribute a larger fraction of the overall emissions.
  - While the FAA continues to do research on a switch to biofuels for aircraft, it may be some time before that becomes the case for helicopters and general aviation.
- If the airport were to be closed, the airport emissions would be a savings to the local community. The overall reduction in total emissions is unknown without a traffic diversion study, but local noise produced by the aircraft and more generally from the airport would likely be greatly reduced

Thank You

Our atmosphere is a razor-thin, delicate layer protecting our planet…we should treat it with respect and care